



I-69 EVANSVILLE TO INDIANAPOLIS TIER 2 STUDIES

Section 5—Final Environmental Impact Statement

APPENDIX TT THIRD LANE ANALYSIS MEMORANDUM



I-69 EVANSVILLE TO INDIANAPOLIS TIER 2 STUDIES

To: Tom Seeman, P.E., INDOT
From: Michael Grovak and Tim Miller, Bernardin, Lochmueller and Associates
Cc: Sandra Flum (INDOT), Mary Jo Hamman & Brian Curtis (Michael Baker, Jr.)
Date: December 17, 2012
Re: Draft Assessment, Need for 3rd Travel Lane in I-69 Section 5

SUMMARY

Bernardin, Lochmueller has reviewed peak period traffic assignments from the I-69 corridor model to determine whether a 3rd travel lane on I-69 Section 5 needs to be provided with the initial project construction in the area between Sample Road and the I-69/SR37 interchange at the southern project limits of Section 5 (northern limits of Section 4). A related question is if traffic volumes do not require a 3rd lane at the time of initial project construction (assumed to be in the vicinity of the Year 2015), when will a 3rd travel lane be required?

An analysis of traffic forecasts prepared on December 6, 2012 indicates the following:

- South of SR 46 (to southern terminus of Section 5) a 3rd travel lane will be warranted between 2025 and 2030.
- North of SR 46 (to Sample Rd.) a 3rd travel lane will be warranted between 2030 and 2035.

Given the results of updated traffic forecasts using the Indiana Statewide Travel Demand Model (ISTDM) 6v2 and the I-69 corridor model, existing and forecasted traffic volumes will not require a 3rd lane on any portion of Section 5 until at least 10 years into the future. Traffic analysis in the DEIS showed no need for a 3rd lane north of Sample Road prior to 2035. Given that the current forecasts are slightly below those in the DEIS, the need for a 3rd lane north of Sample Road was not revisited.

TRAFFIC FORECASTS

Two traffic forecasts (for Year 2020 and Year 2035) were used as the basis of this analysis. Intermediate year traffic estimates (for 2025 and 2030) were calculated using a straight-line interpolation of the 2020 and 2035 traffic forecasts. See the section below headed *Intermediate Year (2025 and 2030 Traffic Estimates)* for a further explanation. Both the 2020 and 2035 forecasts provided traffic for the AM peak hour, PM peak hour, and daily traffic. The attached spreadsheet, *Adjusted Forecasts*, shows forecasted peak hour traffic (both total vehicles and trucks) as well as passenger car equivalents (PCEs) for the Year 2020 and 2035.

2020 Forecasts

To prepare the Section 4 FEIS in 2011, an analysis was conducted to estimate the traffic impacts to SR 37 in Bloomington under the circumstance when Sections 1 through 4 of I-69 are completed, but prior to any upgrades being made to SR 37 (to convert it to I-69). Forecasts incorporating these assumptions were prepared for Year 2015 and 2020. They were the basis of Section 4 FEIS Appendix QQ, *SR 37 Operational and Safety Analysis*.

These forecasts assumed that only Sections 1 through 4 of I-69 were constructed and open to service. They did not assume that Sections 5 or 6 of I-69 were constructed, nor did they assume construction of the I-69 Ohio River Bridge (SIU #4 of the National I-69 project).



2035 Forecasts

2035 forecasts were prepared using the I-69 corridor model, with inputs from ISTDm 6v2. These were prepared in early December of this year, and also are being used as inputs to the TransModeler simulation forecasts. These forecasts assume that all six sections of I-69 are built, and also assume that the I-69 Ohio River Bridge is constructed.

Intermediate Year (2025 and 2030 Traffic Estimates)

Intermediate year traffic estimates are needed to estimate when (during the period between 2020 and 2035) traffic growth requires a 3rd travel lane. To determine traffic in intermediate years, BLA assumed a straight-line interpolation. For example, traffic growth in 2025 corresponds to one-third of the difference between 2020 and 2035.

FORECASTED LANE REQUIREMENTS

Application of Highway Capacity Manual Methodology

The methodology of the Highway Capacity Manual 2010 (HCM 2010) was applied to estimate lane requirements. The key item used is equation 11-7 on p. 11-23 of Volume II of HCM 2010, shown below.

$N = V / (MSF_i * PHF * f_{HV} * f_p)$, where

N = Number of lanes required,

MSF_i = Maximum Service Flow Rate (for targeted Level of Service)

PHF = Peak Hour Factor

f_{HV} = Adjustment factor for presence of heavy vehicles in traffic stream

f_p = Adjustment factor for unfamiliar driver populations

For N (number of lanes required) any fractional values are rounded up. E.G., if this equation states that 2.15 lanes are required to satisfy the targeted LOS, then it is rounded up to 3 lanes.

MSF_i values are obtained from Exhibit 11-17 on p. 11-23 of Volume II of HCM 2010. In this analysis, the targeted LOS is LOS C in all areas. The values of MSF_i vary with the free flow speed. The I-69 corridor model shows a free flow speed of approximately 75 mph north of SR 46 and 65 mph south of SR 46. This corresponds to MSF_i values of 1,750 and 1,630, respectively.

PHF represents the variation in traffic flow within an hour, accounting for the fact that flow rates found in the peak 15 minutes are not sustained throughout the entire hour. South of SR 46, the PHF was assumed to be .94, which is the default value for the Highway Capacity Software (HCS). North of SR 46, the PHF was assumed to be .90. This is a conservative estimate based upon professional judgment.

f_{HV} was computed using equation 11-3, found on page 11-13 of HCM 2010. It was calculated using the forecasted or estimated truck percentages, as well as the calculated passenger car equivalents (PCE) for trucks. Exhibits 11-11 and 11-13 in HCM 2010 (pages 11-16 and 11-17) were used to compute PCEs for trucks. In the analysis area, PCEs generally were 1.5. In the northbound segment between Walnut St. and Sample Rd., and in the southbound segment between Walnut St. and SR 46, the PCEs for trucks were specified as 2.0. These determinations were made by reviewing the Section 5 Plan and Profile sheets showing % grade and length of grade, and applying the values of Exhibits 11-11 and 11-13. The calculation of f_{HV} also considers the presence of recreational vehicles; for this analysis, the presence of recreational vehicles was assumed to be negligible.



f_p , the adjustment factor for unfamiliar driver populations, was assumed to be negligible.

Forecasted Lane Requirements

The attached spreadsheet *Lane Requirements* shows the forecasted lane requirements between interchange pairs at five year intervals, between the Year 2020 and the Year 2025. Yellow highlights show where lane requirements (per direction) are greater than 2.00. Key points on the attached include:

- Forecasted traffic indicates that in the AM peak hour, a portion of I-69 within Bloomington (between 2nd and 3rd Streets) will require a third lane. The lane requirement (2.03) is just over the 2.00 threshold for adding a 3rd lane, per HCM guidance.
- By 2035, peak period forecasts indicate that a 3rd lane is required in both directions throughout Section 5 south of Sample Rd.
- This analysis considers only forecasted mainline traffic and level of service. It does not consider other issues, such as interchange spacing within Bloomington and the impacts of weaving movements at closer-spaced interchanges.

SUMMARY

This analysis indicates that during the period between 2025 and 2030, traffic levels in Section 5 will require a 3rd travel lane in one location (between 2nd Street and 3rd Street) south of SR 46. In the next five years (between 2030 and 2035) traffic levels will require a 3rd lane at many locations throughout Section 5 south of Sample Rd. This analysis considers only mainline traffic and levels of service; it does not consider the effects of interchange spacing and their associated weaving movements.

Maximum Service Flow Rates Per HCM 2010 - Exhibit 11-17 MSFR assumes 75 mph ff speed in rural areas and 65 mph in urban areas	Urban		Rural		Peak Hour Factor	Urban		(HSC default)
	LOS C	1630	1750	0.94				
	LOS D	2030		Rural		0.90	(Prof. judgment)	
	MSFR assumes 75 mph ff speed in rural areas and 65 mph in urban areas							
	Urban Target	1630	Regarded unfamiliar driver proportions as negligible					

Northbound - AM Peak Hour																	
From		Year 2020				Year 2025				Year 2030				Year 2035			
		Heavy Veh.		Lanes		Heavy Veh.		Lanes		Heavy Veh.		Lanes		Heavy Veh.		Lanes	
		PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required
SR 37	Fullerton Pike	1,493	10%	0.95	1.03	2,027	10%	0.95	1.39	2,576	11%	0.95	1.77	3,110	11%	0.95	2.14
Fullerton Pike	Tapp Rd	1,461	11%	0.95	1.00	2,105	10%	0.95	1.45	2,768	10%	0.95	1.90	3,411	10%	0.95	2.34
Tapp Rd	2nd St	1,632	9%	0.95	1.12	2,058	10%	0.95	1.41	2,498	11%	0.95	1.72	2,924	11%	0.95	2.01
2nd St	3rd St	1,703	10%	0.95	1.17	2,317	10%	0.95	1.59	2,950	10%	0.95	2.03	3,564	10%	0.95	2.45
3rd St	SR 46	1,575	11%	0.95	1.08	2,209	11%	0.95	1.52	2,861	11%	0.95	1.97	3,495	11%	0.95	2.40
SR 46	Walnut St	700	23%	0.90	0.49	1,395	20%	0.91	0.97	2,110	17%	0.92	1.50	2,805	14%	0.93	1.92
Walnut St	Sample Rd	1,151	20%	0.83	0.88	1,831	18%	0.85	1.37	2,532	15%	0.87	1.90	3,212	13%	0.89	2.29

Northbound - PM Peak Hour																	
From		Year 2020				Year 2025				Year 2030				Year 2035			
		Heavy Veh.		Lanes		Heavy Veh.		Lanes		Heavy Veh.		Lanes		Heavy Veh.		Lanes	
		PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required
SR 37	Fullerton Pike	1,110	5%	0.98	0.74	1,532	5%	0.98	1.02	1,968	5%	0.98	1.31	2,390	5%	0.98	1.59
Fullerton Pike	Tapp Rd	1,095	4%	0.98	0.73	1,669	4%	0.98	1.11	2,260	4%	0.98	1.51	2,834	4%	0.98	1.89
Tapp Rd	2nd St	1,318	4%	0.98	0.88	1,648	4%	0.98	1.10	1,987	4%	0.98	1.32	2,317	4%	0.98	1.54
2nd St	3rd St	1,545	4%	0.98	1.03	2,097	4%	0.98	1.40	2,666	4%	0.98	1.78	3,218	4%	0.98	2.14
3rd St	SR 46	1,832	4%	0.98	1.22	2,331	4%	0.98	1.55	2,846	4%	0.98	1.90	3,345	4%	0.98	2.23
SR 46	Walnut St	910	5%	0.97	0.60	1,413	5%	0.97	0.93	1,932	5%	0.97	1.30	2,435	5%	0.97	1.59
Walnut St	Sample Rd	1,432	4%	0.96	0.95	1,963	4%	0.96	1.30	2,509	4%	0.96	1.71	3,040	4%	0.96	2.01

Southbound - AM Peak Hour																	
From		Year 2020				Year 2025				Year 2030				Year 2035			
		Heavy Veh.		Lanes		Heavy Veh.		Lanes		Heavy Veh.		Lanes		Heavy Veh.		Lanes	
		PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required
SR 37	Fullerton Pike	978	17%	0.92	0.69	1,290	17%	0.92	0.92	1,611	18%	0.91	1.15	1,923	19%	0.91	1.38
Fullerton Pike	Tapp Rd	998	17%	0.92	0.71	1,455	16%	0.92	1.03	1,927	16%	0.93	1.36	2,384	15%	0.93	1.67
Tapp Rd	2nd St	1,231	13%	0.94	0.85	1,514	14%	0.93	1.06	1,807	16%	0.93	1.27	2,090	17%	0.92	1.48
2nd St	3rd St	1,414	12%	0.94	0.98	1,835	13%	0.94	1.27	2,270	13%	0.94	1.58	2,691	13%	0.94	1.87
3rd St	SR 46	1,537	10%	0.95	1.06	1,993	11%	0.95	1.37	2,462	12%	0.94	1.70	2,918	13%	0.94	2.03
SR 46	Walnut St	923	18%	0.85	0.69	1,518	17%	0.85	1.13	2,130	16%	0.86	1.62	2,725	16%	0.86	2.01
Walnut St	Sample Rd	1,430	14%	0.94	0.97	1,884	14%	0.94	1.28	2,352	14%	0.93	1.64	2,806	14%	0.93	1.92

Southbound - PM Peak Hour																	
From		Year 2020				Year 2025				Year 2030				Year 2035			
		Heavy Veh.		Lanes		Heavy Veh.		Lanes		Heavy Veh.		Lanes		Heavy Veh.		Lanes	
		PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required	PCEs	Truck %	Adj. Factor	Required
SR 37	Fullerton Pike	1,558	4%	0.98	1.04	1,958	4%	0.98	1.30	2,370	4%	0.98	1.58	2,770	4%	0.98	1.84
Fullerton Pike	Tapp Rd	1,600	3%	0.98	1.07	2,150	3%	0.98	1.43	2,717	3%	0.98	1.81	3,267	3%	0.98	2.18
Tapp Rd	2nd St	1,876	4%	0.98	1.25	2,151	4%	0.98	1.43	2,435	4%	0.98	1.62	2,710	4%	0.98	1.80
2nd St	3rd St	1,850	3%	0.98	1.23	2,361	3%	0.98	1.57	2,886	3%	0.98	1.92	3,397	3%	0.98	2.26
3rd St	SR 46	1,595	4%	0.98	1.06	2,146	4%	0.98	1.43	2,714	4%	0.98	1.81	3,265	4%	0.98	2.17
SR 46	Walnut St	832	5%	0.95	0.56	1,453	5%	0.95	0.97	2,094	5%	0.95	1.44	2,715	5%	0.95	1.81
Walnut St	Sample Rd	1,163	4%	0.98	0.75	1,799	4%	0.98	1.17	2,455	4%	0.98	1.63	3,091	4%	0.98	2.00

		Northbound																							
		Year 2020												Year 2035											
		AM Peak				PM Peak				Daily				AM Peak				PM Peak				Daily			
From	To	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %
SR 37	Fullerton Pike	132	1,295	1,493	10%	50	1,035	1,110	5%	2,782	16,877	21,050	16%	287	2,679	3,110	11%	108	2,228	2,390	5%	5,943	32,333	41,248	18%
Fullerton Pike	Tapp Rd	135	1,258	1,461	11%	42	1,032	1,095	4%	2,824	16,687	20,923	17%	295	2,968	3,411	10%	109	2,670	2,834	4%	6,072	36,598	45,706	17%
Tapp Rd	2nd St	135	1,429	1,632	9%	53	1,238	1,318	4%	2,817	19,855	24,081	14%	279	2,505	2,924	11%	93	2,177	2,317	4%	5,829	30,689	39,433	19%
2nd St	3rd St	149	1,479	1,703	10%	54	1,464	1,545	4%	3,059	21,864	26,453	14%	306	3,105	3,564	10%	113	3,048	3,218	4%	6,222	39,502	48,835	16%
3rd St	SR 46	146	1,357	1,575	11%	66	1,733	1,832	4%	2,927	22,721	27,112	13%	321	3,013	3,495	11%	121	3,163	3,345	4%	6,368	39,605	49,157	16%
SR 46	Walnut St	121	518	700	23%	45	842	910	5%	2,459	10,837	14,526	23%	324	2,319	2,805	14%	121	2,253	2,435	5%	6,282	28,428	37,851	22%
Walnut St	Sample Rd	165	822	1,151	20%	58	1,316	1,432	4%	3,301	16,493	23,095	20%	326	2,560	3,212	13%	124	2,792	3,040	4%	6,328	32,036	44,692	20%
		Southbound																							
		Year 2020												Year 2035											
		AM Peak				PM Peak				Daily				AM Peak				PM Peak				Daily			
From	To	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %	Trucks	Total Veh.	PCEs	Truck %
SR 37	Fullerton Pike	130	783	978	17%	57	1,472	1,558	4%	2,579	17,196	21,065	15%	282	1,500	1,923	19%	101	2,618	2,770	4%	5,858	30,103	38,890	19%
Fullerton Pike	Tapp Rd	135	795	998	17%	52	1,522	1,600	3%	2,659	17,900	21,889	15%	292	1,946	2,384	15%	107	3,106	3,267	3%	6,039	35,586	44,645	17%
Tapp Rd	2nd St	136	1,027	1,231	13%	65	1,778	1,876	4%	2,782	20,210	24,383	14%	280	1,670	2,090	17%	94	2,569	2,710	4%	5,841	30,340	39,102	19%
2nd St	3rd St	148	1,192	1,414	12%	60	1,760	1,850	3%	2,905	22,519	26,877	13%	301	2,239	2,691	13%	110	3,232	3,397	3%	6,173	37,791	47,051	16%
3rd St	SR 46	137	1,331	1,537	10%	59	1,506	1,595	4%	2,739	21,187	25,296	13%	322	2,435	2,918	13%	121	3,083	3,265	4%	6,360	37,038	46,578	17%
SR 46	Walnut St	121	681	923	18%	38	756	832	5%	2,392	10,752	15,536	22%	328	2,069	2,725	16%	125	2,465	2,715	5%	6,343	29,388	42,074	22%
Walnut St	Sample Rd	161	1,188	1,430	14%	48	1,091	1,163	4%	3,069	15,880	20,484	19%	331	2,309	2,806	14%	127	2,900	3,091	4%	6,401	32,972	42,574	19%